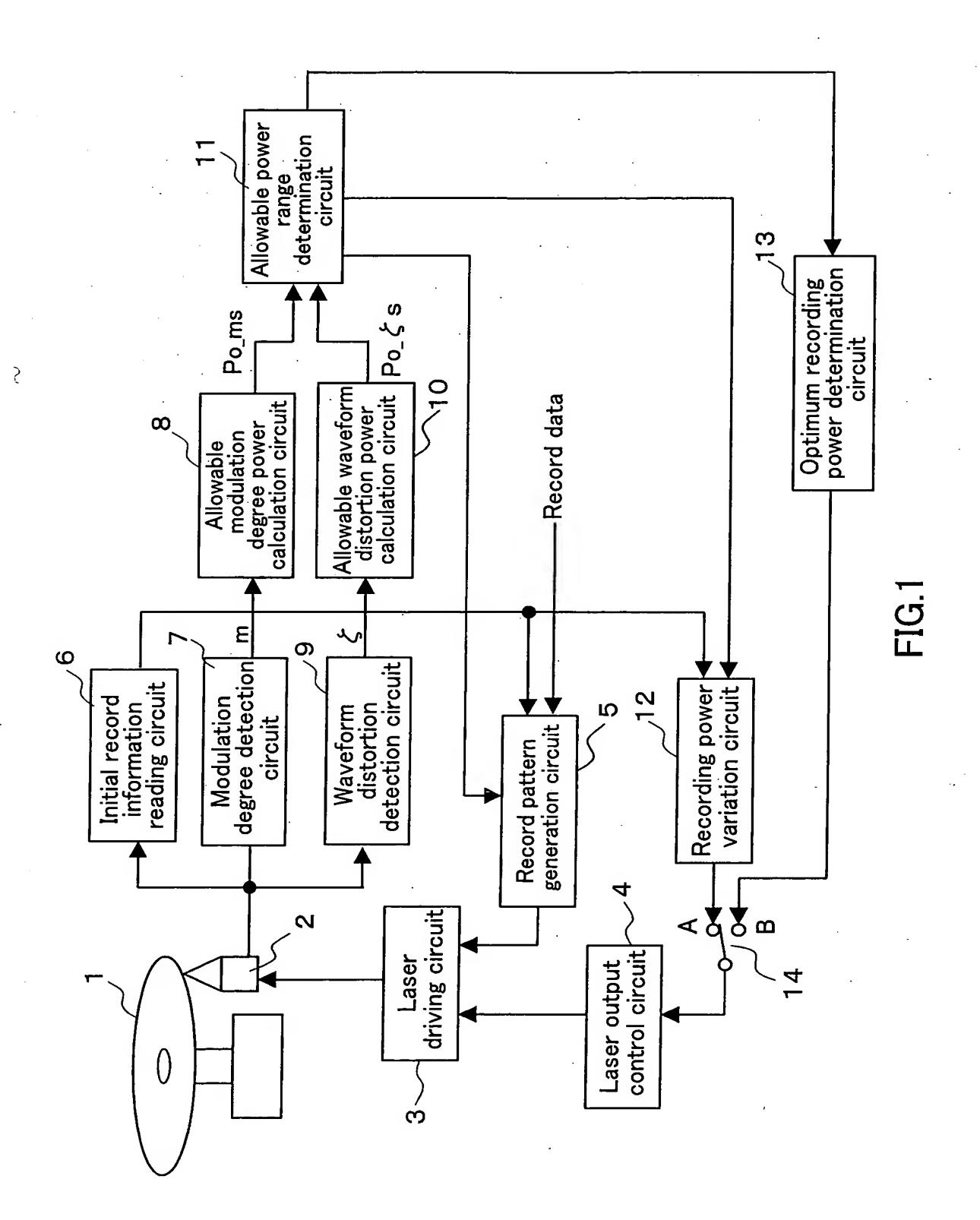Inventor: IMURA et al.
Docket No.: 10873.1827USWO
Title: OPTICAL INFORMATION RECORDING/REPRODUCING APPARATUS AND
METHOD FOR LEARNING RECORDING LIGHT INTENSITY (AS AMENDED)
Attorney Name: Douglas P. Mueller
Phone No.: 612.455.3804
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FIG.1

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Docket No.: 10873.1827USWO
Title: OPTICAL INFORMATION RECORDING/REPRODUCING APPARATUS AND
METHOD FOR LEARNING RECORDING LIGHT INTENSITY (AS AMENDED)
Attorney Name: Douglas P. Mueller
Phone No.: 612.455.3804
Sheet 2 of 17

Start of learning recording power

Read initial record information necessary for learning recording power from target recording medium — S201

Set record information necessary for learning recording power (recording start power Po, recording power ratio ε, recording power increment ΔPo, recording waveform for learning recording power, etc.) — S202

Move to recording power learning region — S203

Record data for learning recording power at recording powers Po(i), Pm(i) (i = 1, 2,···), a recording power ratio there between being maintained at a constant value — S204

Reproduce data for learning recording power — S205

S206
Detect degree of modulation m from reproduced signal

S208
Detect waveform distortion amount ζ from reproduced signal

Calculate recording power Po_ms corresponding to allowable upper limit degree of modulation ms

Calculate recording power Po_ζs corresponding to allowable waveform distortion amount ζs

S207

S209

S10
Po_ms $\geqq$ Po_ζs

Yes

No

S211
Determine allowable recording Power range to be a range from Po_ζs to Po_ms

S213
No — Intermediate pulse inserted

Yes

S215
Increase width of intermediate pulse

Determine optimum recording power Pw within allowable recording power range

S212

S214
Insert intermediate pulse

End of learning recording power

FIG.2

Inventor: IMURA et al.
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Title: OPTICAL INFORMATION RECORDING/REPRODUCING APPARATUS AND
METHOD FOR LEARNING RECORDING LIGHT INTENSITY (AS AMENDED)
Attorney Name: Douglas P. Mueller
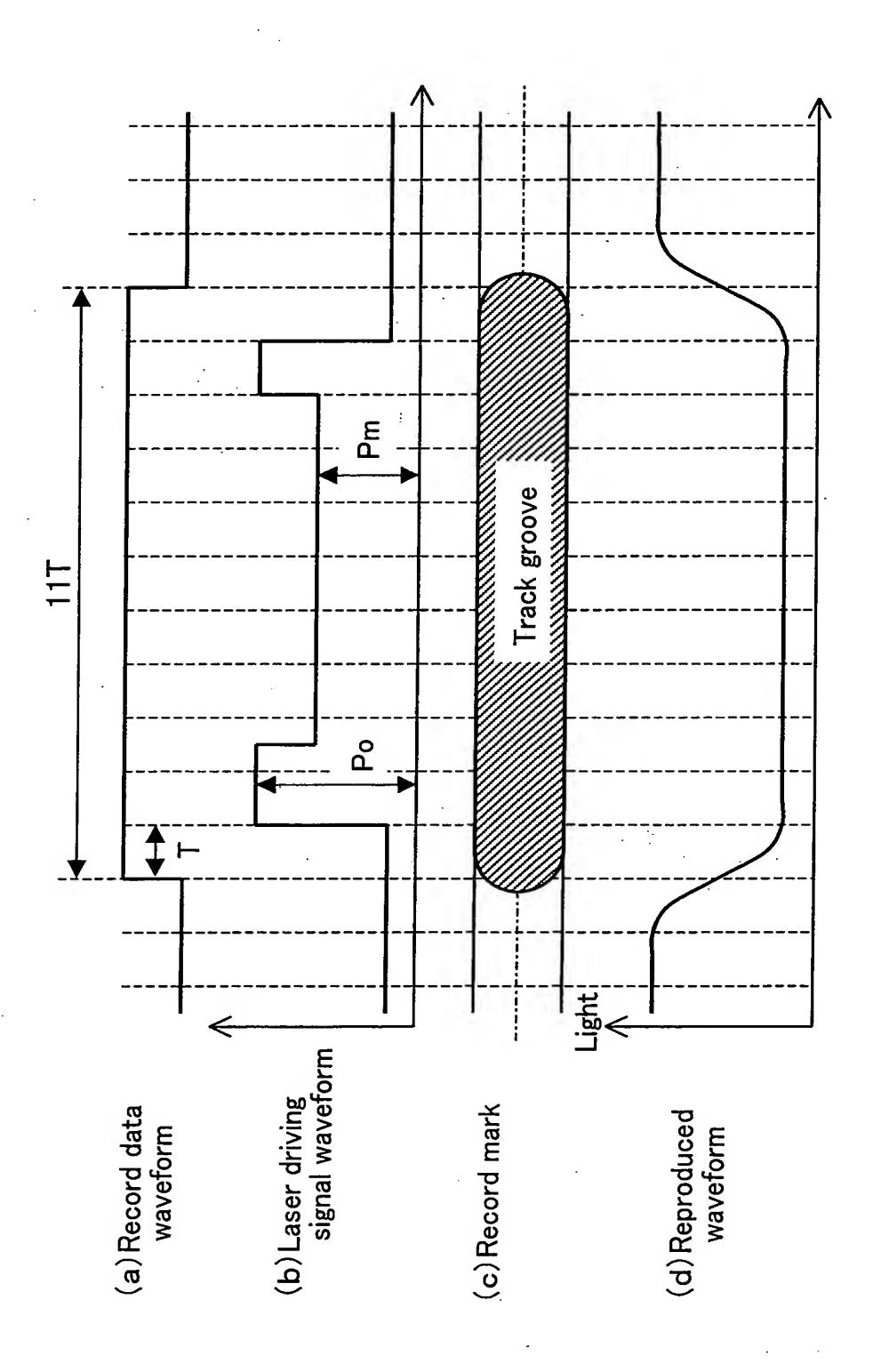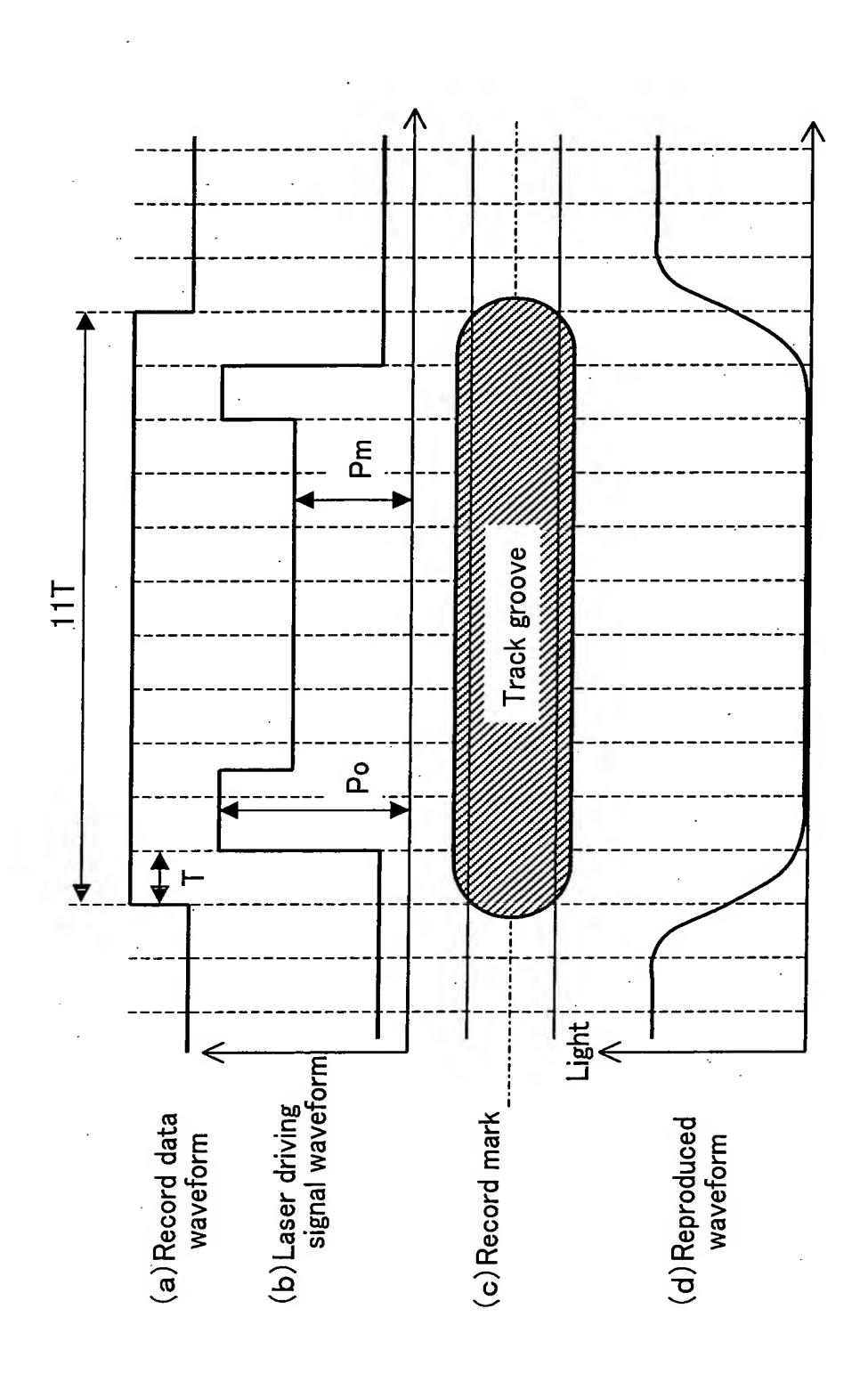Phone No.: 612.455.3804
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(a) Record data waveform

(b) Laser driving signal waveform

(c) Record mark

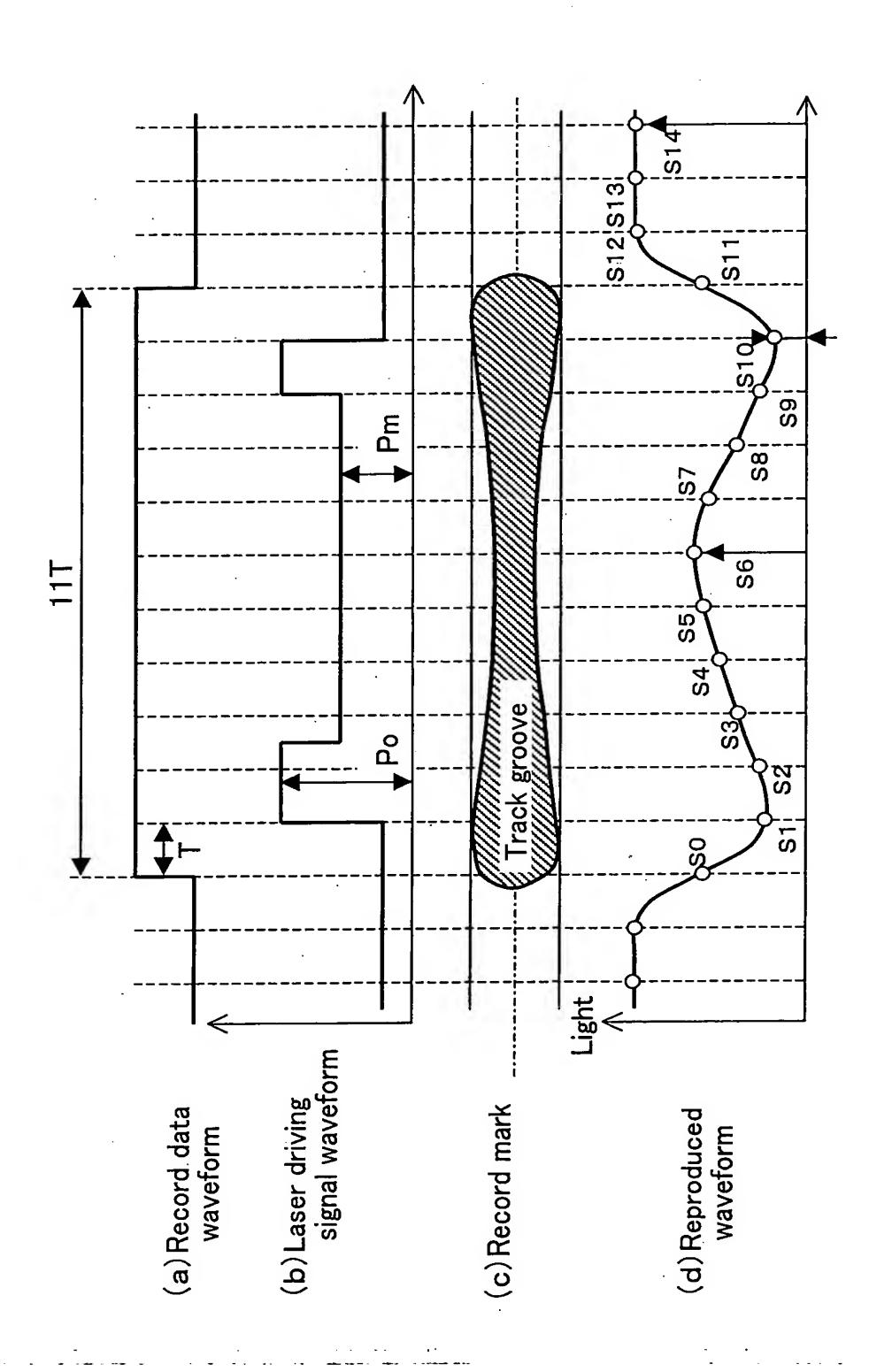(d) Reproduced waveform

FIG.3

Inventor: IMURA et al.
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Title: OPTICAL INFORMATION RECORDING/REPRODUCING APPARATUS AND
METHOD FOR LEARNING RECORDING LIGHT INTENSITY (AS AMENDED)
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(a) Record data waveform

(b) Laser driving signal waveform

(c) Record mark

(d) Reproduced waveform

Track groove

11T

Pm

Po

T

Light

FIG.4

Inventor: IMURA et al.
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Title: OPTICAL INFORMATION RECORDING/REPRODUCING APPARATUS AND
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Attorney Name: Douglas P. Mueller
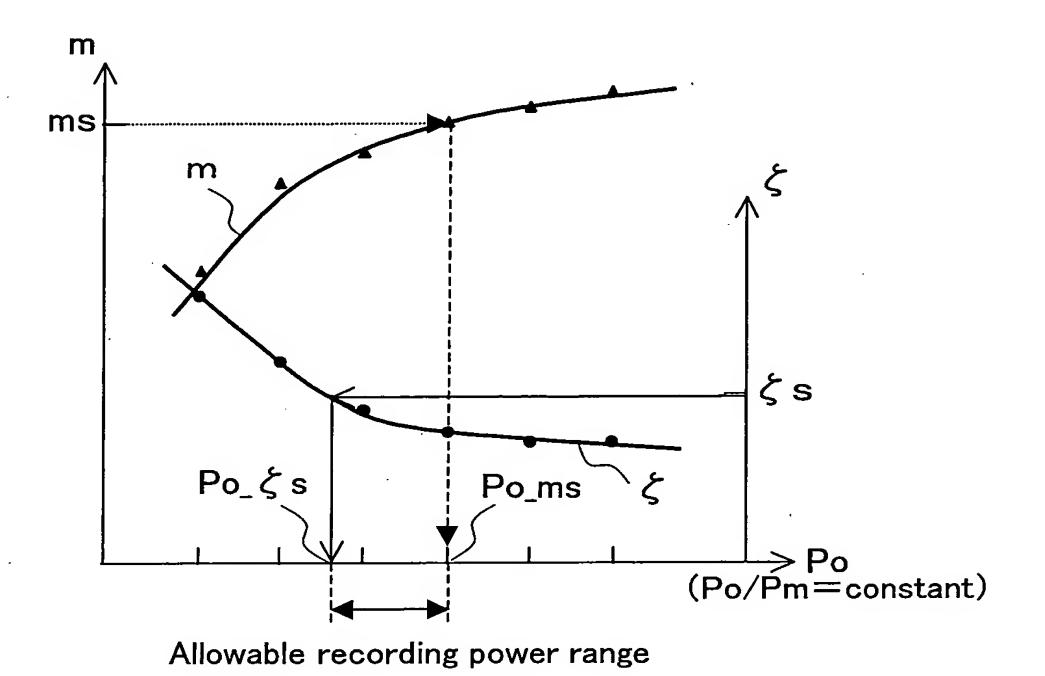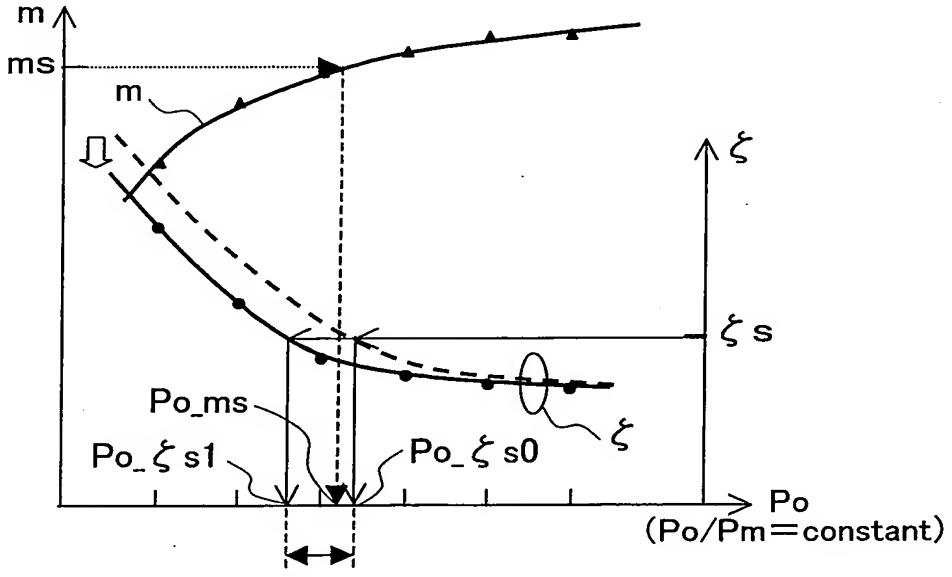Phone No.: 612.455.3804
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(a) Record data
waveform

(b) Laser driving
signal waveform

(c) Record mark

(d) Reproduced
waveform

FIG.5

Inventor: IMURA et al.
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Title: OPTICAL INFORMATION RECORDING/REPRODUCING APPARATUS AND
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Attorney Name: Douglas P. Mueller
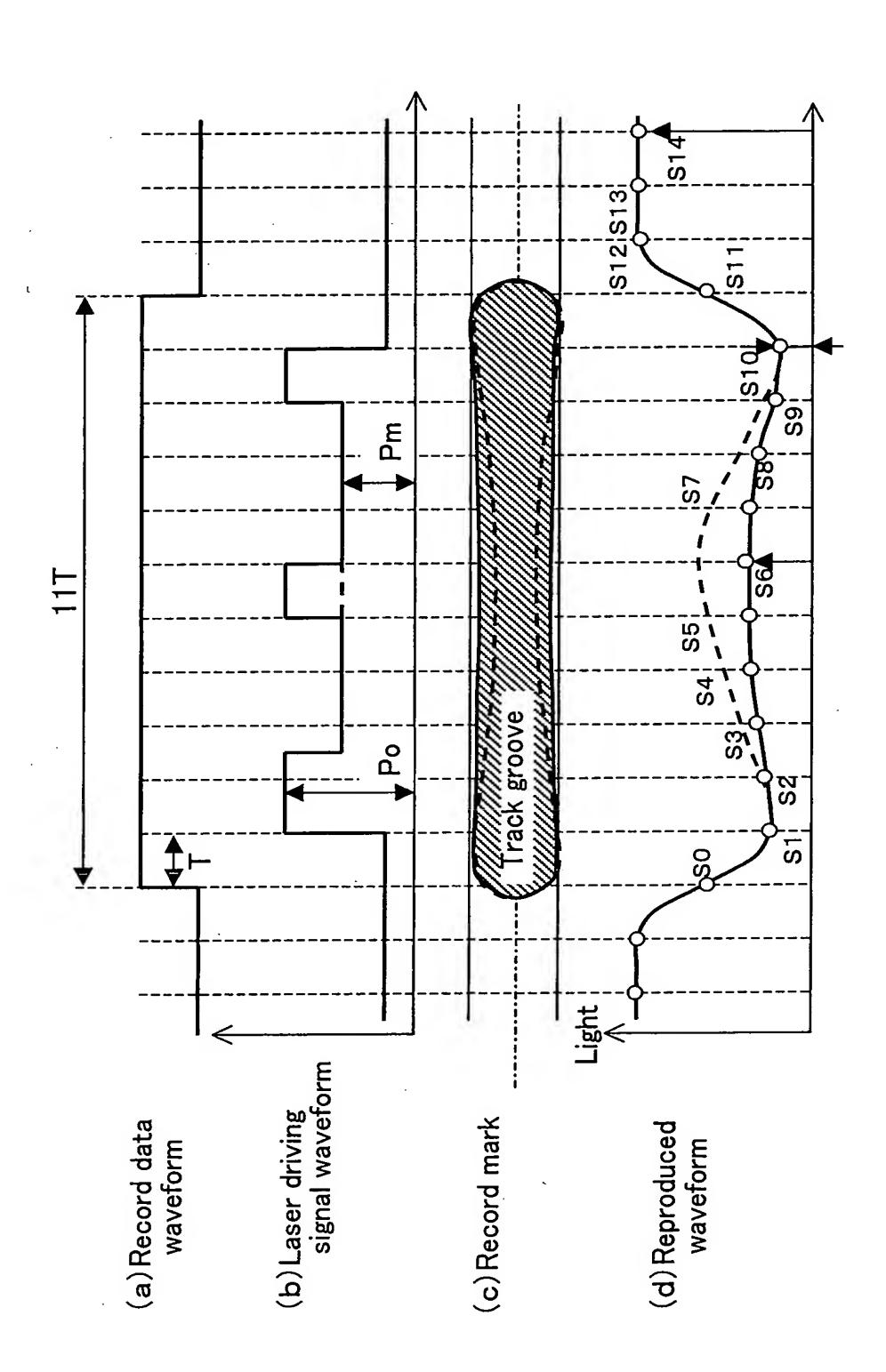Phone No.: 612.455.3804
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FIG.6

FIG.7

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Title: OPTICAL INFORMATION RECORDING/REPRODUCING APPARATUS AND
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Attorney Name: Douglas P. Mueller
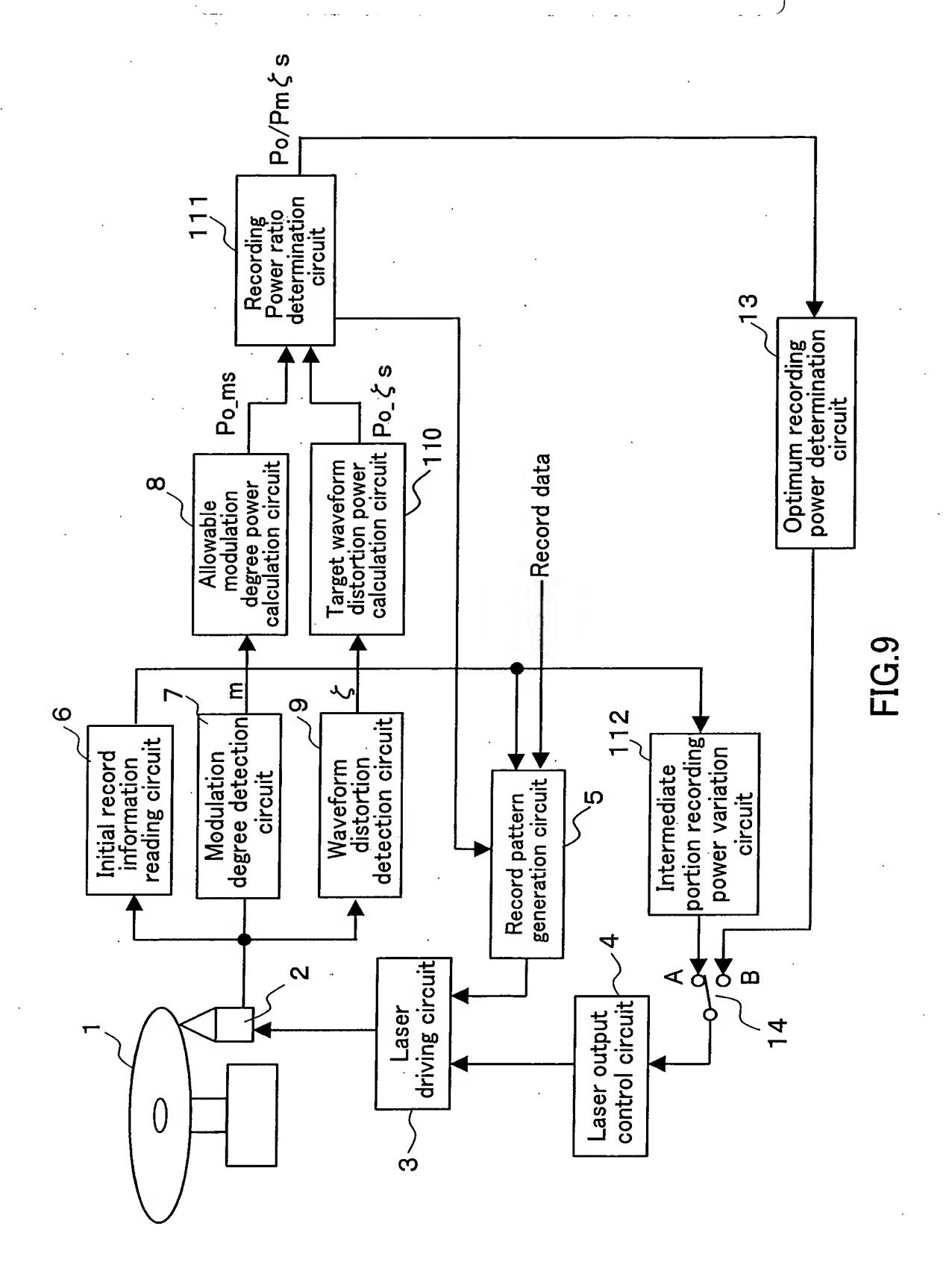Phone No.: 612.455.3804
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(a) Record data
waveform

11T

T

(b) Laser driving
signal waveform

Pm

Po

(c) Record mark

Track groove

(d) Reproduced
waveform

Light

S0
S1
S2
S3
S4
S5
S6
S7
S8
S9
S10
S11
S12 S13
S14

FIG.8

Inventor: IMURA et al.
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FIG.9

Inventor: IMURA et al.
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Attorney Name: Douglas P. Mueller
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Start of learning recording power

Read initial record information necessary for learning recording power from target recording medium — S201

Set recording information necessary for learning recording power (first recording power Po, second recording start power Pm, second recording power increment ΔPm, recording waveform for learning recording power, etc.) — S302

Move to recording power learning region — S203

Record data for learning recording power at recording powers Po(i), Pm(i) (i = 1, 2,···), a recording power ratio there between being maintained at a constant value — S304

Reproduce data for learning recording power — S205

S306
Detect degree of modulation m from reproduced signal

S308
Detect waveform distortion amount ζ from reproduced signal

Calculate recording power Pm_ms corresponding to allowable upper limit degree of modulation ms

S307

Calculate recording power Pm_ζt corresponding to allowable waveform distortion amount ζt

S309

S310
Po_ms $\geqq$ Po_ζs
Yes / No

S311
Determine recording power ratio (Po/Pm_ζt) corresponding to target waveform distortion amount ζt in learning power as optimum recording power ratio

S213
Intermediate pulse inserted
No / Yes

S215
Increase width of intermediate pulse

S214
Insert intermediate pulse

End of learning recording power
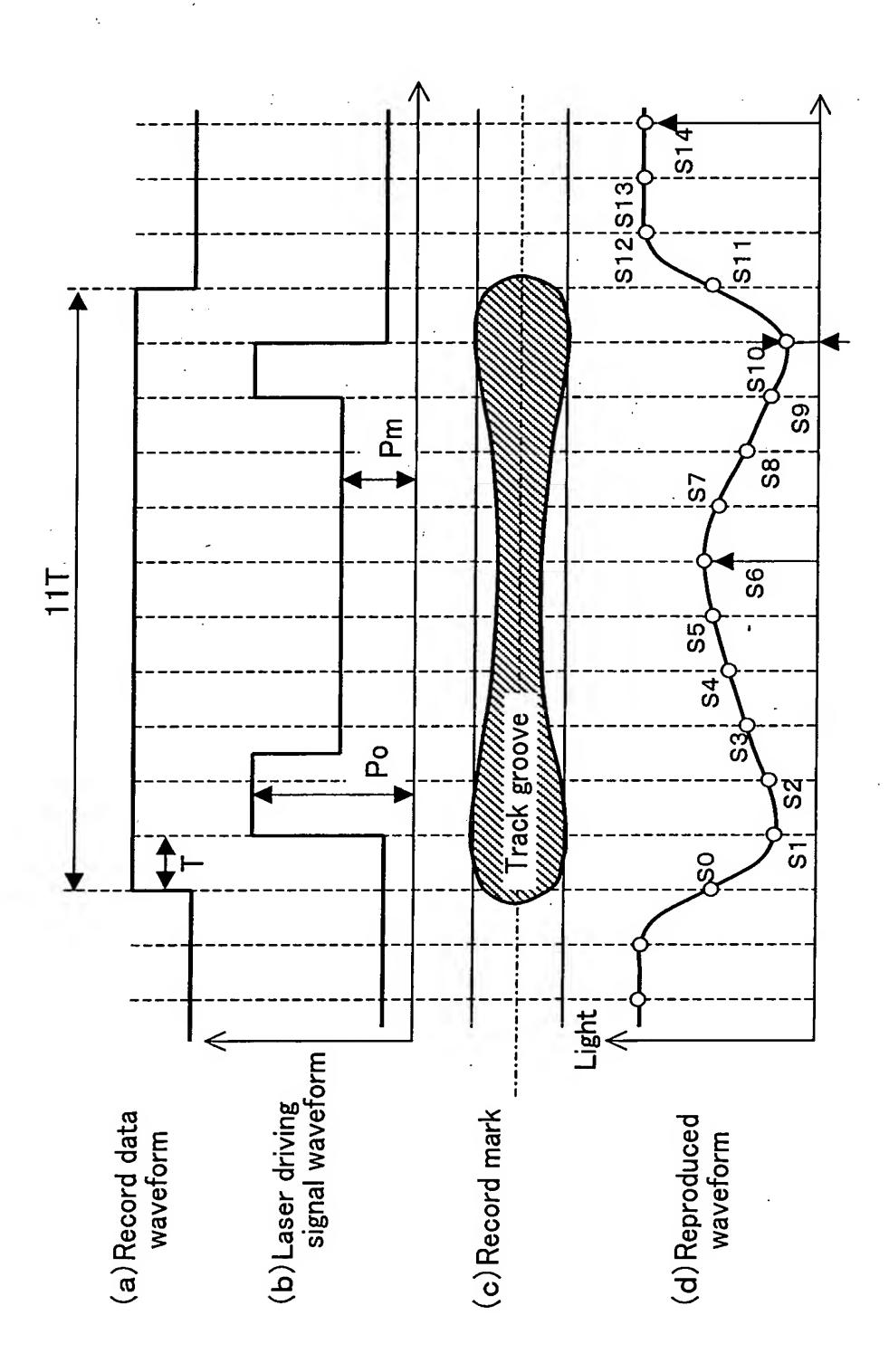
FIG.10

Inventor: IMURA et al.
Docket No.: 10873.1827USWO
Title: OPTICAL INFORMATION RECORDING/REPRODUCING APPARATUS AND
METHOD FOR LEARNING RECORDING LIGHT INTENSITY (AS AMENDED)
Attorney Name: Douglas P. Mueller
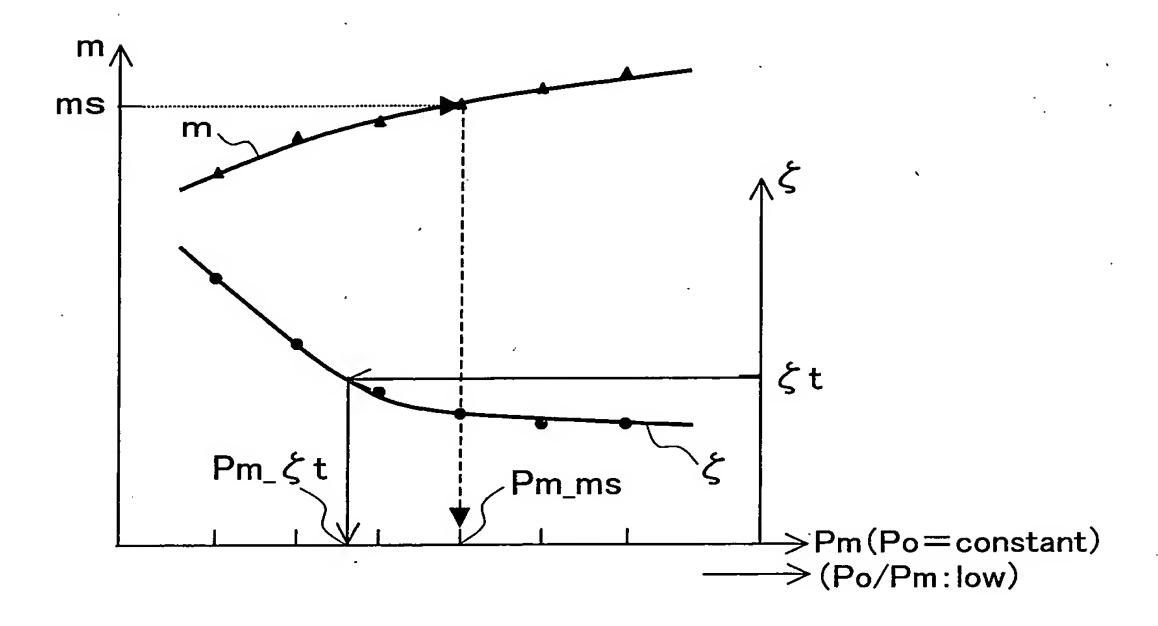Phone No.: 612.455.3804
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(a) Record data waveform

(b) Laser driving signal waveform

(c) Record mark

(d) Reproduced waveform

FIG.11

Inventor: IMURA et al.
Docket No.: 10873.1827USWO
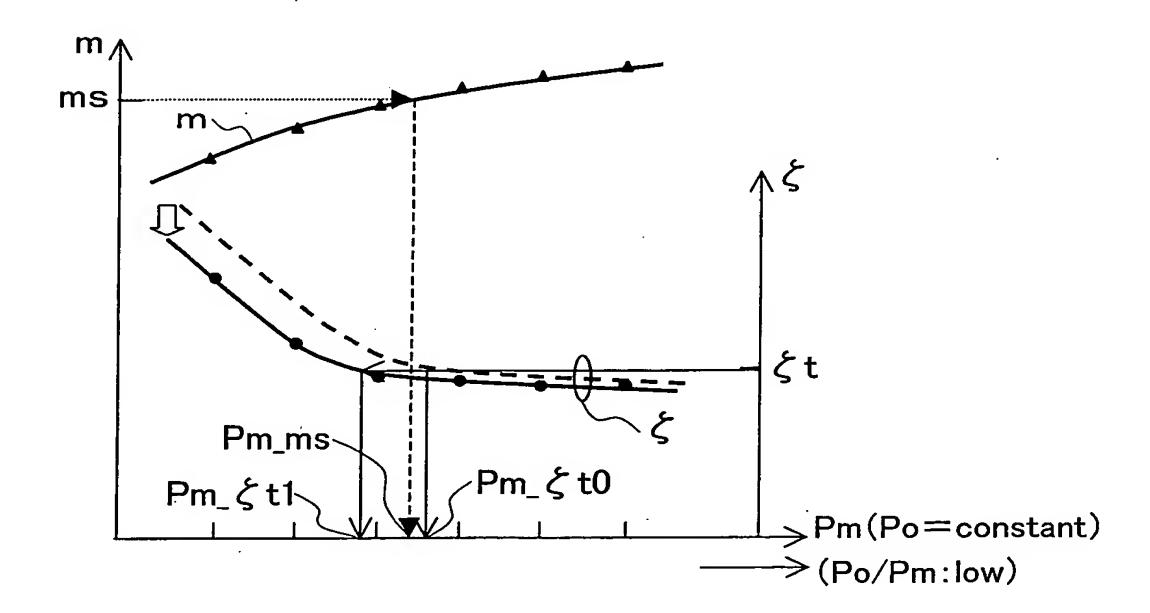Title: OPTICAL INFORMATION RECORDING/REPRODUCING APPARATUS AND
METHOD FOR LEARNING RECORDING LIGHT INTENSITY (AS AMENDED)
Attorney Name: Douglas P. Mueller
Phone No.: 612.455.3804
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(a) Record data waveform

(b) Laser driving signal waveform

(c) Record mark

(d) Reproduced waveform

FIG.12

Inventor: IMURA et al.
Docket No.: 10873.1827USWO
Title: OPTICAL INFORMATION RECORDING/REPRODUCING APPARATUS AND
METHOD FOR LEARNING RECORDING LIGHT INTENSITY (AS AMENDED)
Attorney Name: Douglas P. Mueller
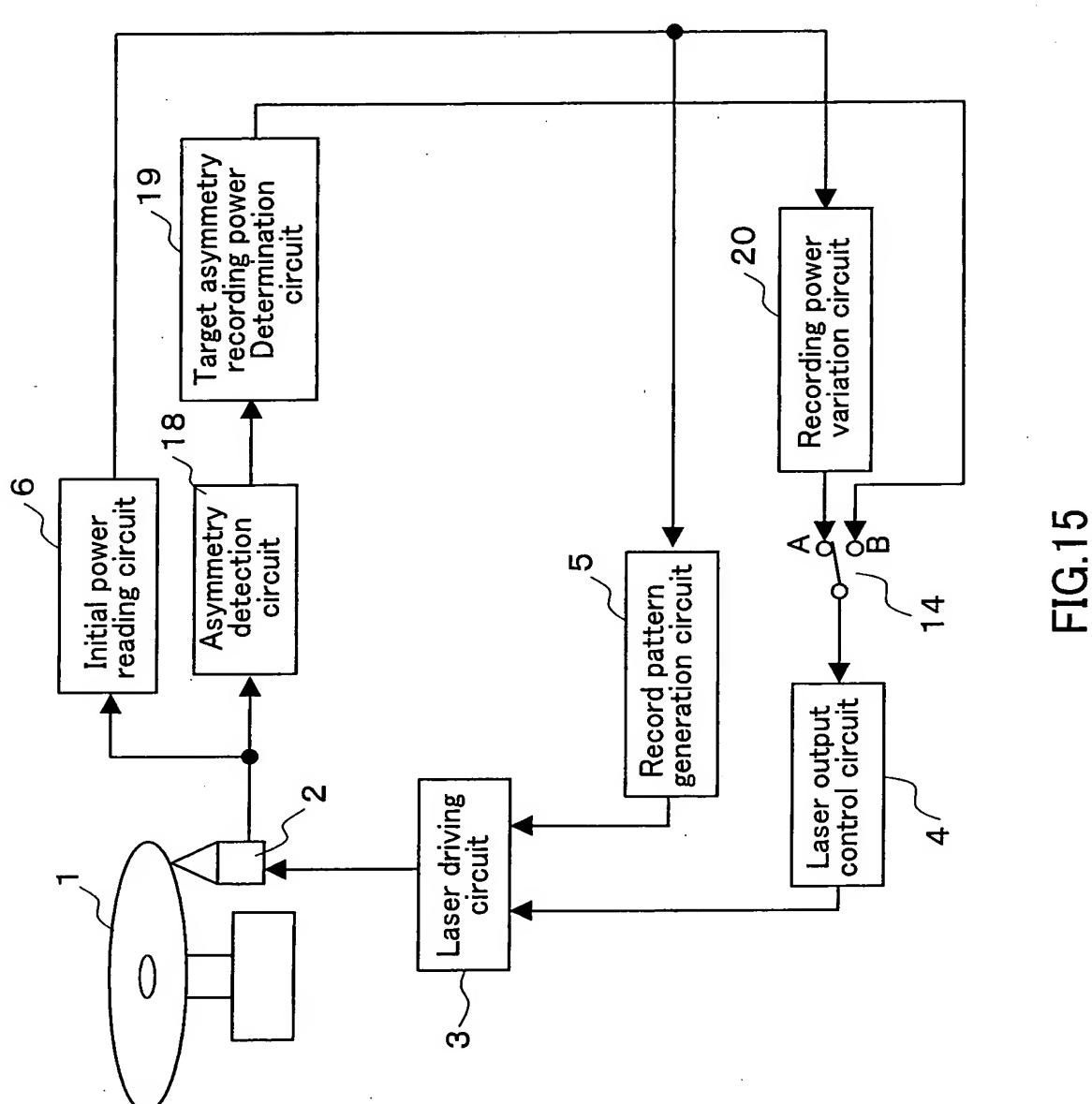Phone No.: 612.455.3804
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FIG.13

FIG.14

Inventor: IMURA et al.
Docket No.: 10873.1827USWO
Title: OPTICAL INFORMATION RECORDING/REPRODUCING APPARATUS AND
METHOD FOR LEARNING RECORDING LIGHT INTENSITY (AS AMENDED)
Attorney Name: Douglas P. Mueller
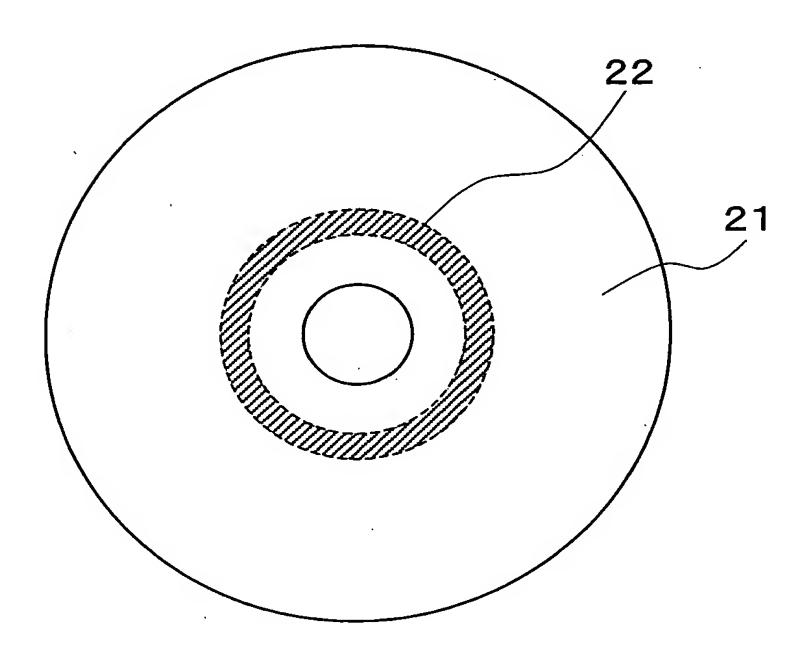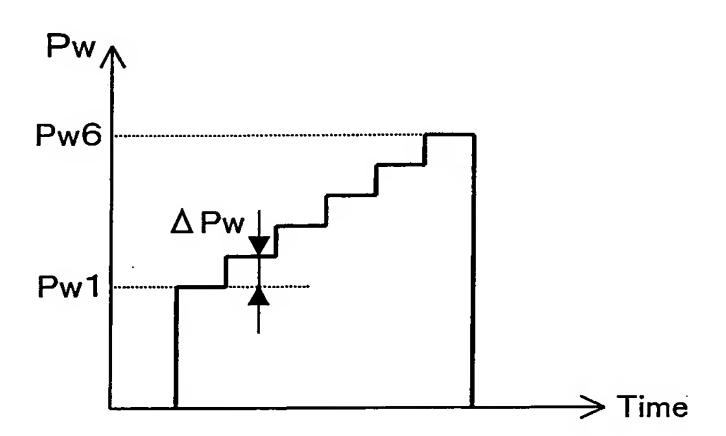Phone No.: 612.455.3804
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FIG.15

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Title: OPTICAL INFORMATION RECORDING/REPRODUCING APPARATUS AND
METHOD FOR LEARNING RECORDING LIGHT INTENSITY (AS AMENDED)
Attorney Name: Douglas P. Mueller
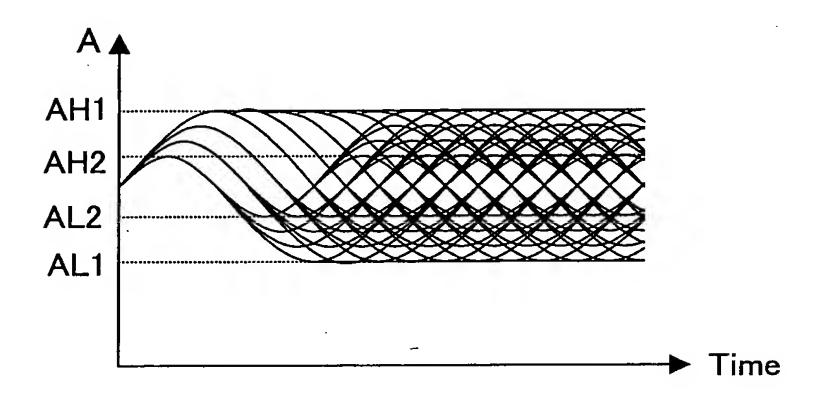Phone No.: 612.455.3804
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FIG.16

FIG.17

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Title: OPTICAL INFORMATION RECORDING/REPRODUCING APPARATUS AND
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Attorney Name: Douglas P. Mueller
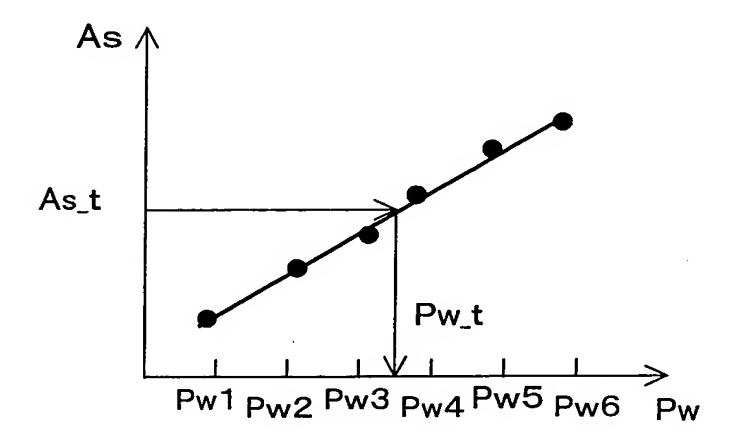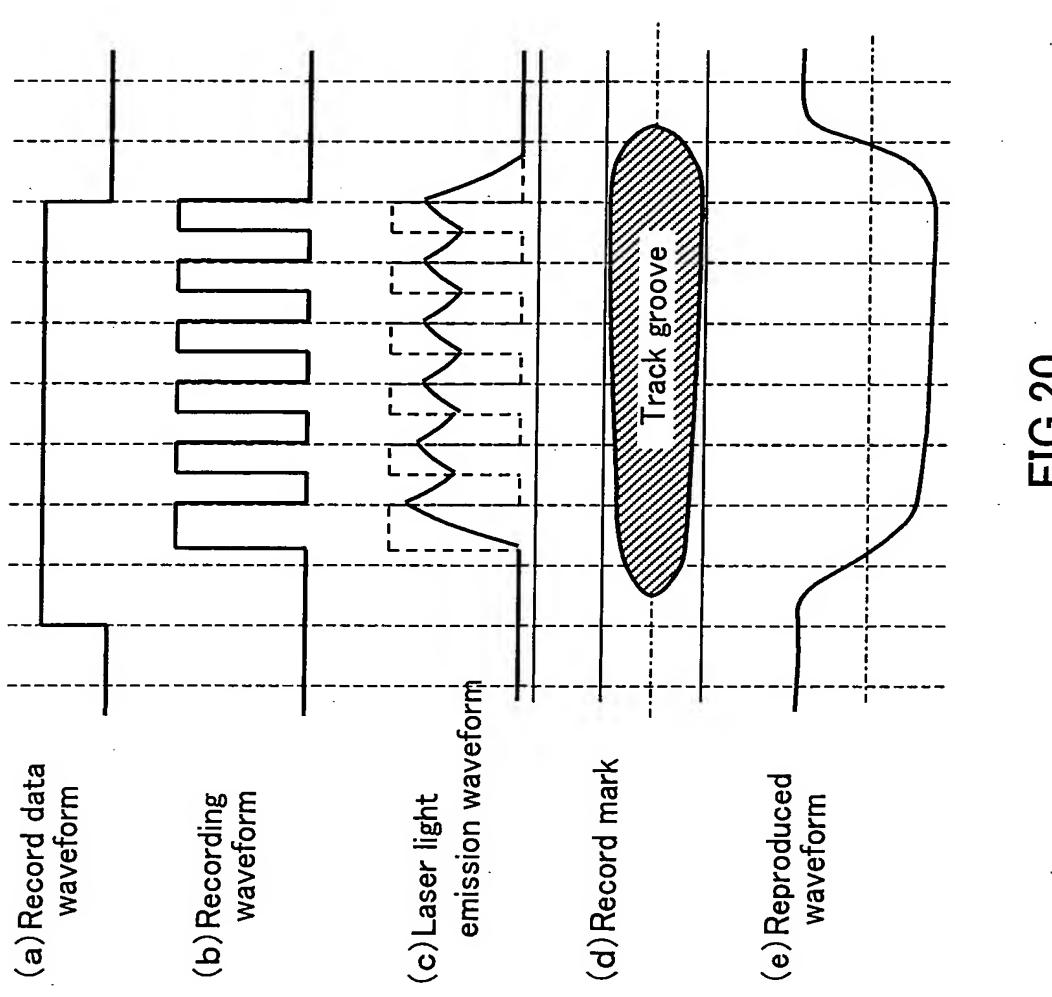Phone No.: 612.455.3804
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FIG.18

FIG.19

Inventor: IMURA et al.
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Attorney Name: Douglas P. Mueller
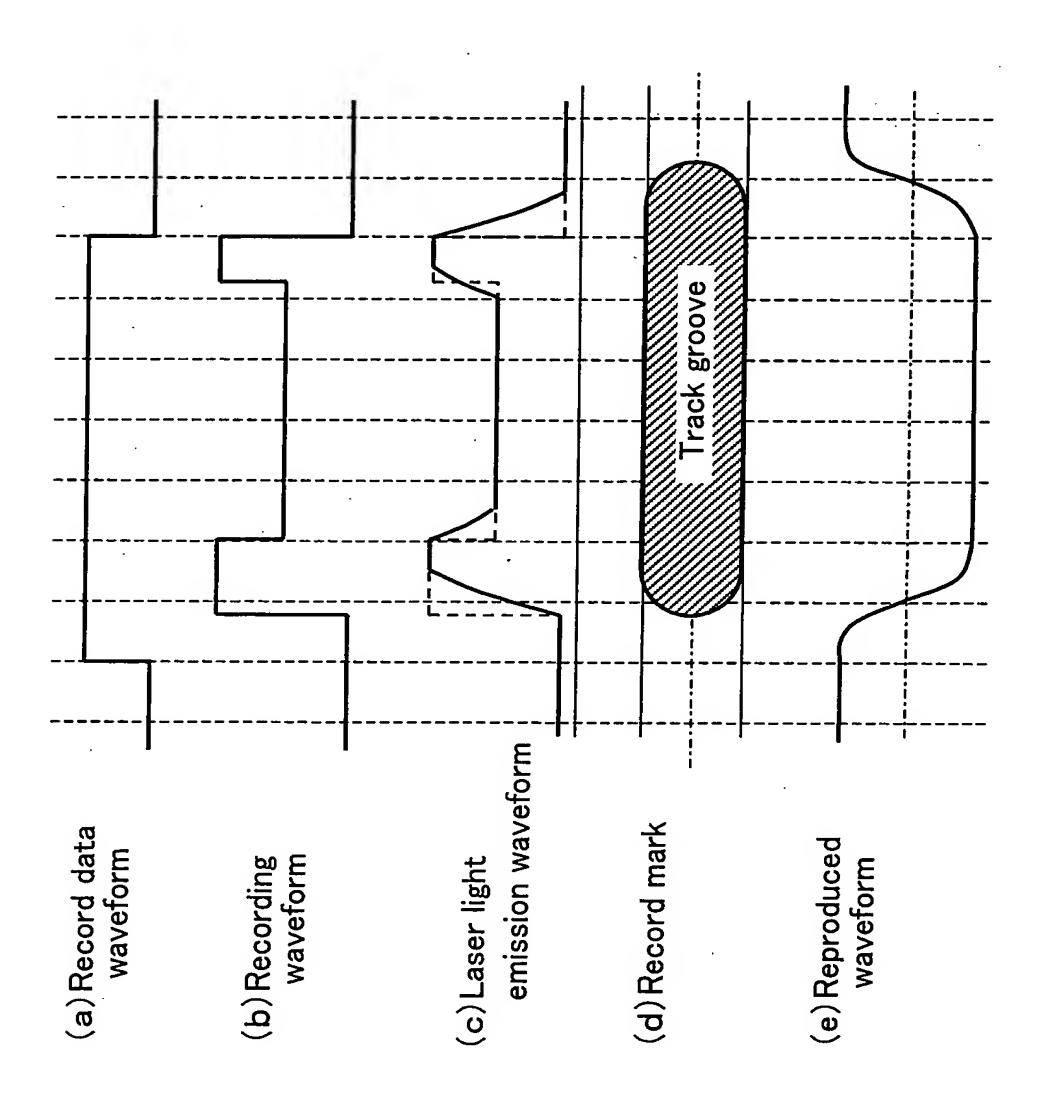Phone No.: 612.455.3804
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(a) Record data waveform

(b) Recording waveform

(c) Laser light emission waveform

(d) Record mark

Track groove

(e) Reproduced waveform

FIG.20

(a) Record data waveform

(b) Recording waveform

(c) Laser light emission waveform

(d) Record mark

Track groove

(e) Reproduced waveform

FIG.21